REMARKS

Claims 9-16 have been canceled and new claims 17-28 have been added. Claims 17-28 are readable on FIGS. 2 and 3.

Claims 9-11, 13, 14 and 16 stand rejected under 35 USC 112, second paragraph. Applicant believes that the new claims 17-28 are not open to rejection under 35 USC 112, second paragraph.

Claims 9 and 13 stand rejected under 35 USC 103 over Harndorf in view of Aldinger.

The subject matter of claim 17 is a common rail fuel injection apparatus for controlling fuel injection. In accordance with claim 17, a body part (the body part 5 of the structure shown in FIGS. 2 and 3) defines an interior space and also defines a fuel inlet (designated 7) and a fuel outlet (8) that open respectively into and from the interior space. In operation of the fuel injection apparatus, fuel flows through the interior space. A piston means (9) is movable in the interior space alternately towards and away from the fuel outlet. The apparatus provides flow connection between the fuel inlet and the fuel outlet by at least a first flow path (35.1) that provides continuous flow connection and a second flow path (35) of which the cross-sectional flow area increases when the piston means moves towards the fuel outlet.

In the embodiment shown in FIGS. 2 and 3, the opening 35.1 (which provides continuous flow connection) allows equalization of the pressure between the inlet chamber and the outlet chamber after the injection and permits the spring 10 to return the piston to its initial position without depressurizing the inlet side of the valve. As the piston means moves towards the fuel outlet, the control edge 40 releases more openings 35, thus increasing the cross-sectional flow area of the second flow path.

The examiner relies on FIG. 2 of Harndorf as disclosing a common rail fuel system. In the common rail fuel injection system, a high pressure pump 3 supplies fuel to the common rail 5, which is connected to injectors 21 via respective high pressure conduits 12, each provided with a flowthrough valve 7 and a throttle element 19. The flow through valve 7 is selectively opened (9) and closed (8) as shown in FIG. 3 to control supply of high pressure fuel to the injector 21 by way of the throttle element 19, which prevents "an over-stressing

of the injection rate within the ignition delay phase" (column 5, line 66-column 6, line 1).

Aldinger discloses a traditional injection pump by means of which the pressure of fuel is raised to a level suitable for injection. Each injector is connected to its own injector pump. The pump comprises a valve 6, 7, 8 that controls the connection between the pump chamber 5 and a conduit 9' leading to the injector. When the piston 2 is in its lowermost position, the flow connection between the inlet and outlet openings of the valve is closed. As the piston 2 moves upwards, the fuel pressure in the pump chamber 5 increases and moves the valve member 8 upwards and the flow connection from the inlet opening via the throttling recesses 23, 24 to the outlet opening (conduit 9') opens and pressurized fuel flows to the injector. There is a flow connection between the inlet opening 4 and outlet opening 9' only during the injection.

The quantity of fuel supplied to the injector depends on the angular position of the valve member 8, which is controlled by an operating member 13. When the valve member 8 is positioned so that the throttling recess 23 is opposite the throttling recess 24, the effective cross-section of the throttling passage is a maximum and in this position the control valve regulates the maximum number of revolutions (per unit time) of the combustion engine (column 4, lines 7-9). Thus, if the number of revolutions increases, the fluid pressure in the chamber 5 increases, the valve member 8 moves upwards and the annular recess 18 registers with the port 25 and fuel escapes through the relief conduit 26 to the low pressure supply conduit 4. A smaller amount of fuel reaches the combustion engine and the number of revolutions of the engine then decreases. Turning of the valve member 8 in the direction of the arrow 28 shown in FIG. 2 reduces the effective cross-section of the throttling passage. The pressure in the pump chamber 5 increases more rapidly as the piston 2 moves upwards and the valve member 8 moves upwards to a position in which the annular recess 18 communicates with the port 25 so that fuel escapes into the relief conduit 26. See column 4, lines 25-39.

The control valve disclosed by Aldinger is not suitable for use in a common rail fuel system because the pressure on the inlet side of the valve is released to the relief conduit 4 after the injection. In a common rail system, this would cause excessive pressure fluctuations

in the common rail when high pressure fuel is led from the common rail to the low pressure fuel valve inlet as the injection starts again and thus would cause perturbations in the operation of the system.

Aldinger does not disclose or suggest that a continuous flow connection should be provided between the inlet and outlet openings, and the valve of Aldinger would not operate if it were provided such a connection because the pressure would escape from the pump chamber 5 through the flow connection during the upward movement of the piston 2 and the injection pressure would not reach the desired level.

For the reasons explained above, it would not have been obvious to a person of ordinary skill in the art to use the control valve of Aldinger in a common rail fuel injection system as disclosed by Harndorf and, moreover, it would not have been obvious to a person of ordinary skill in the art to modify the control valve disclosed by Aldinger by providing a continuous flow connection between the inlet opening and the outlet opening.

In view of the foregoing, applicant submits that the subject matter of claim 17 is not disclosed or suggested by Aldinger and Harndorf, whether taken singly or in combination. Therefore, claim 17 is patentable and it follows that the dependent claims also are patentable.

Respectfully submitted,

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